

KARTHIK KASHINATH

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Education

- **University of Cambridge** Cambridge, U.K.
Doctor of Philosophy in Engineering Sep. 2013
 - Thesis: Nonlinear phenomena in thermoacoustic systems with premixed flames
 - Supervisor: Dr. Matthew Juniper, Adviser: Professor Dame Ann Dowling
 - **Coursework grade: First Class Honours** (for awards and publications refer later sections)
- **Stanford University** Stanford, CA, U.S.A.
Master of Science in Mechanical Engineering (Energy and Thermofluids) Sep. 2007 - Jun. 2009
 - Research projects:
 - Coal energy conversion with aquifer-based carbon sequestration
 - Combined electrolyzer and Carbon fuel cell system for cogeneration of hydrogen and electricity
 - **GPA: 3.88 / 4.0**
- **Indian Institute of Technology - Madras (IIT Madras)** Chennai, India
Bachelor of Technology in Mechanical Engineering Aug. 2003 - Jun. 2007
 - Thesis: Improved fuel-air mixing in supersonic combustion ramjets using opposed cavities
 - **GPA: 8.74 / 10.0**

Research Experience

- **Lawrence Berkeley National Lab - Earth Sciences Division** Berkeley, CA, U.S.A.
Project Scientist, Advisor: Professor William D. Collins Dec. 2013 - present
 - Evaluating and improving the fidelity of global climate models in predicting extreme weather and climate events.
 - Identifying the physical mechanisms and the interaction between large scale and small scale processes during extreme weather phenomena.
 - Applying nonlinear dynamical systems techniques to study climate dynamics.
- **Cambridge University Engineering Department** Cambridge, U.K.
PhD Student Oct. 2009 - Sep. 2013
 - Investigated the complex nonlinear behaviour of ducted premixed flames using coupled flame-acoustic solvers in the time domain.
 - Applied dynamical systems theory and nonlinear time series analysis techniques to understand the periodic, quasi-periodic, frequency-locked and chaotic behaviour of thermoacoustic systems.
 - Studied the influence of hydrodynamics on the nonlinear behaviour of ducted premixed flames.
 - Derived analytical criteria to predict limit cycle amplitudes, stability and bifurcation phenomena using the acoustic energy equation and the flame describing function.
- **Global Climate and Energy Program (GCEP), Stanford University** Stanford, CA, U.S.A.
Research Assistant (10 hrs/wk concurrently with Masters coursework) Jan. 2009 - Jun. 2009
 - Simulated heat transfer and fluid flow within supercritical fluid pipelines of a coal reformer for the GCEP project - Coal Energy Conversion with Aquifer-Based Carbon Sequestration.
- **Thermosciences Division, Dept. of Mech. Eng., Stanford University** Stanford, CA, U.S.A.
Research Analyst (Advanced energy systems project) Mar. 2009 - Jun. 2009
 - Modelled a novel energy device consisting of a direct Carbon solid oxide fuel cell in conjunction with a reductant enhanced electrolyzer for the cogeneration of electricity and hydrogen.
- **Innovations in Advanced Engineering Group, RENAULT** Paris, France
Summer Intern Jun. 2008 - Aug. 2008
 - Developed a mathematical model to predict battery performance in electric vehicles across diverse operating conditions and geographical locations, including effects of climate control devices.

Applied Computational Fluid Dynamics Laboratory

• John F Welch Technology Center, General Electric Company

Bangalore, India

Summer Intern

Jun. 2005 - Aug. 2005

- Re-designed the burner locations of GE Gas Ovens based on deductions from experimental heat transfer studies to reduce non-uniformities in the temperature distribution.
- Modelled a novel electronics cooling device that uses piezo-actuated vibrating fins to improve temperature drop by 50 percent compared to conventional fin-cooling.
- Won the 2005 GE Best Intern Award for research innovation and effective communication.

• Thermodynamics and Combustion Eng. Laboratory, IIT Madras

Chennai, India

Research Assistant

Jun. 2004 - Jun. 2007

- Improved fuel-air mixing in ducted supersonic flows using cavity oscillations of opposed cavities.
- Optimized cavity geometry and relative positions to yield maximum mixing enhancement.
- Results were presented at a peer-reviewed international conference (refer section on Publications).

Teaching Experience and Public Engagement

Cambridge University Engineering Department

Cambridge, U.K.

• Teaching Assistant (part time, 10 hrs/wk)

Sep. 2012 - Jun. 2013

• Supervisor (part time, 8 hrs/wk)

Jan. 2010 - Jun. 2012

- Supervising undergraduate students in Fluid Mechanics, Thermodynamics, Heat and Mass Transfer, Compressible flows, Turbomachinery and Numerical Methods in Engineering.

• Teach First and Reach Cambridge

Cambridge, U.K.

• Teacher and coordinator

Apr. 2010, 2011, 2012 and Jul. 2011

- Designed and implemented parts of a 3-week course, including practical sessions, to inspire high school students from disadvantaged backgrounds to pursue engineering degrees at university.

• Department of Mechanical Engineering, Stanford University

Stanford, CA, U.S.A.

• Teaching Assistant (part time, 20 hrs/wk)

Sep. 2007 - Jun. 2009

- Tutored undergraduate students for courses in energy, thermal and fluid sciences.
- Directed the installation of a new water tunnel in the Stanford Fluid Mechanics Laboratory and designed new experiments for the undergraduate fluids engineering lab.
- Nominated for the Stanford University Centennial Teaching Assistant award in 2009.

• National Innovation Foundation - India (NIF)

Ahmedabad, India

• Co-organiser and reviewer

Dec. 2005 - Feb. 2007

- Organized a national level competition called 'Engenious' to harness the creative spirit of engineers to devise innovative solutions for technological problems in rural India.

Scholarships, Fellowships and Awards

Doctoral Research Scholarships, Fellowships and Awards

- Leonardo da Vinci prize 2013 for outstanding doctoral research in fluid mechanics, turbulence, combustion and acoustics (Europe-wide). (*EUR 1000*)
- American Society of Mechanical Engineers (ASME) International Gas Turbine Institute (IGTI) Scholarship 2012 for outstanding doctoral research in gas turbine technologies. (*\$2,000*)
- ERCOFTAC (European Research Community On Flow, Turbulence and Combustion) 10th Osborne Reynolds Research Student Award 2012 for the best doctoral research (UK-wide). (*£500*)
- Best paper award in the 2012 ASME Turbo Expo conference in the committee on "Combustion, Fuels and Emissions".
- Best poster award in the 2010 meeting of the Combustion Institute (British section) on "Gas turbine combustion: present and future challenges". (*£100*)
- Dorothy Hodgkin post-graduate award for doctoral research at the University of Cambridge. (*£90,000*)
- Trinity College Rouse Ball Research Grant in 2012 and the Ford of Britain Trust Research Grants in 2010, 2011 and 2012. (*£4,000*)

Other Scholarships, Fellowships and Awards

- Stanford Graduate Teaching Assistantship in 2007-08 and 2008-09 to pursue a Masters in Mechanical Engineering while simultaneously working as a Teaching Assistant at 20 hours per week. (\$87,500)
- Nominated for the Stanford University Centennial Teaching Assistant Award in 2009 for “teaching assistants who display unusual commitment to, and excellence in, teaching”.
- 2006 Summer Research Fellowship from the Indian Academy of Sciences for research in environmental fluid dynamics at the Centre for Atmospheric and Ocean Science, Bangalore. (INR 12,000)
- 2006 Summer Research Fellowship from the Jawaharlal Nehru Centre for Advanced Scientific Research for research in turbulence. (INR 12,000)
- GE Best Intern Award in 2005 for achieving excellence in research, innovation and communication of ideas. (INR 10,000)
- First in the university-level nation-wide Indian National Mathematics Olympiad in 2004. (INR 5,000)

Publications

Journal Publications

- “Nonlinear phenomena in thermoacoustic systems with premixed flames”, *ASME Journal of Engineering for Gas Turbines and Power*, June 2013, Vol. 135, 061502.
- “Nonlinear thermoacoustics of ducted premixed flames: the influence of perturbation convection speed”, *Combustion and Flame*, Dec 2013, Vol. 160 (12), pp. 2856–2865.
- “Nonlinear self-excited thermoacoustic oscillations of a ducted premixed flame: bifurcations and routes to chaos”, *Journal of Fluid Mechanics* (under review).
- “Matrix-free continuation of limit cycles and their bifurcations for a ducted premixed flame”, *Journal of Fluid Mechanics* (under review).

Refereed Conference Publications

- “Nonlinear self-excited thermoacoustic oscillations of a ducted premixed flame: bifurcations and routes to chaos”, *Int’l Workshop on Non-Normal and Nonlinear Effects in Aero- and Thermo-acoustics*, Munich, Germany, 2013.
- “Nonlinear phenomena in thermoacoustics: a comparison between single-mode and multi-mode methods”, *19th International Congress on Sound and Vibration*, Vilnius, Lithuania, 2012.
- “Effects of nonuniform reactant stoichiometry on combustion instability”, *Proceedings of ASME Turbo Expo 2011: Power for Land, Sea and Air - GT2011*, Vancouver, Canada, 2011.
- “Effects of cooling liner on acoustic energy absorption and flame response”, *Proceedings of ASME Turbo Expo 2010: Power for Land, Sea and Air - GT2010*, Glasgow, U.K., 2010.
- “Investigation of the effect of combustor cooling geometry on acoustic energy absorption”, *Proceedings of the 16th AIAA/CEAS Aeroacoustics Conference*, Stockholm, Sweden, 2010.
- “Enhancement of fuel-air mixing in supersonic flow by wall-mounted opposed cavities”, *International Symposium on Air-Breathing Engines (ISABE)*, Munich, Germany, 2005.

Other Conference Publications

- “Complex nonlinear oscillations of a ducted premixed flame: periodicity, quasi-periodicity and chaos”, *65th Annual Meeting of the APS Division of Fluid Dynamics*, San Diego, California, 2012.

Peer-Review Experience

Manuscript review for the American Society of Mechanical Engineers Turbo Expo Conference.